

S. Town.

INAUGURAL DISSERTATION,
BEING
AN ATTEMPT TO PROVE
THAT
CERTAIN SUBSTANCES
ARE CONVEYED,
UNCHANGED,
INTO THE
CIRCULATION);
OR,
IF CHANGED,
THAT THEY ARE
RECOMPOSED AND REGAIN
THEIR ACTIVE PROPERTIES.

—♦—
By EDWARD DARRELL SMITH, A. M.
OF CHARLESTON, SOUTH-CAROLINA,
MEMBER OF THE PHILADELPHIA MEDICAL SOCIETY.



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AN
INAUGURAL DISSERTATION,

FOR THE DEGREE OF
DOCTOR OF MEDICINE;

SUBMITTED TO THE

EXAMINATION

OF THE

REV. JOHN EWING, S. T. P. PROVOST,

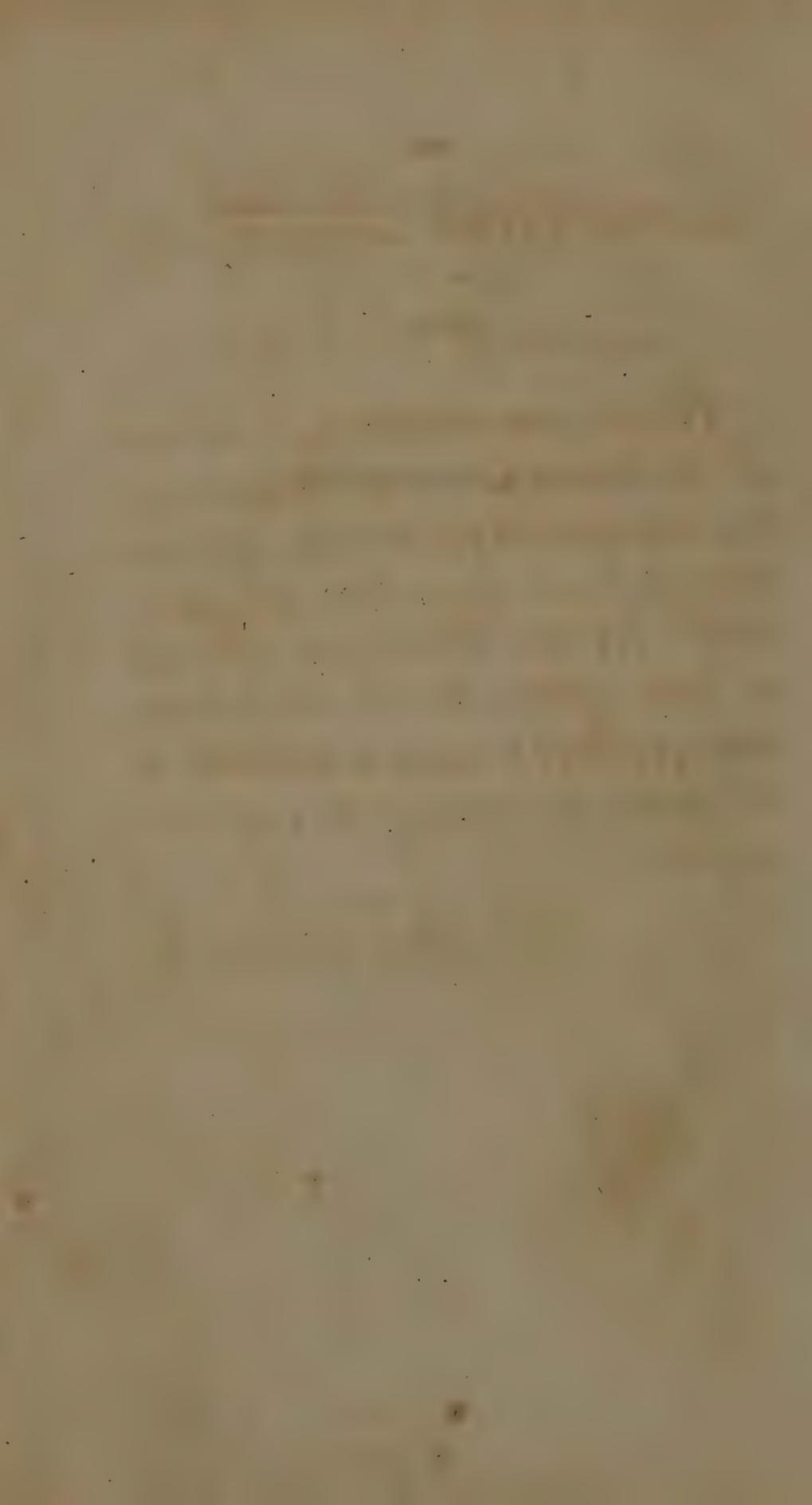
THE

TRUSTEES & MEDICAL FACULTY,

OF THE

UNIVERSITY OF PENNSYLVANIA,

On the thirty-first of May 1806.



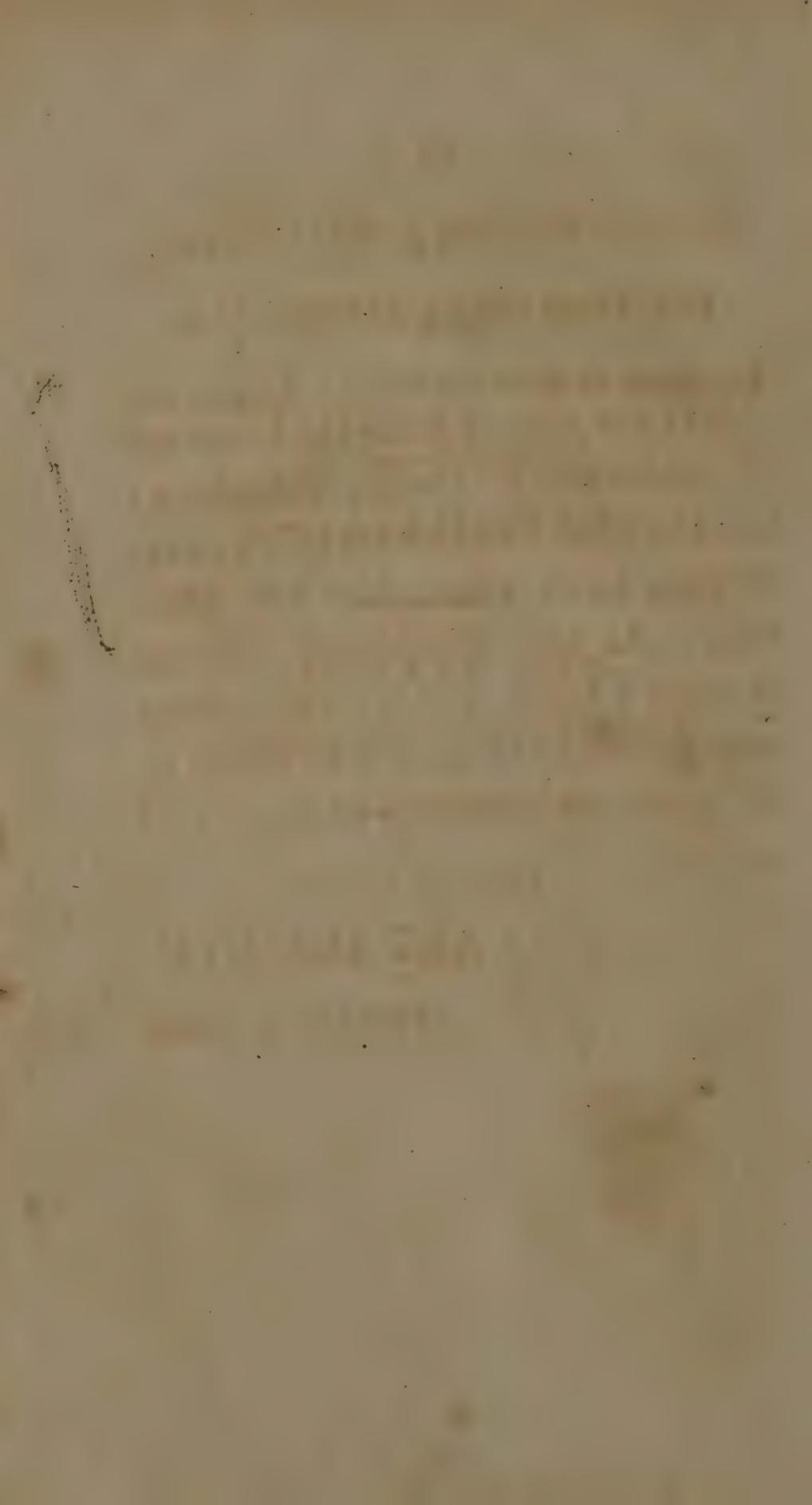
TO

DOCTOR WILLIAM SMITH STEVENS.



TO the man of sense the language of adulation is always disgusting ; but the grateful effusions of an overflowing heart afford him real pleasure. As the affectionate offering of such a heart, receive the tribute now proffered by one, who stands in the double relationship of pupil and nephew.

EDWARD D. SMITH.



TO

BENJAMIN SMITH BARTON, M. D.

PROFESSOR OF MATERIA MEDICA, BOTANY, AND

NATURAL HISTORY, &c.

THIS DISSERTATION

IS INSCRIBED

AS A MARK OF

RESPECT AND OF GRATITUDE,

FOR NUMEROUS FAVOURS

CONFERRED UPON HIS

OBLIGED FRIEND,

EDWARD D. SMITH.

INTRODUCTION.



DURING the reign of the Humoral Pathology, the opinion, that substances were conveyed unchanged into the circulation, was necessarily adopted by the supporters of that doctrine. It was supposed that disease was seated in the fluids of the human body, and that medicines were valuable in proportion to their power of correcting or altering the vitiated fluids. Succeeding and more accurate observations having induced the belief that the doctrine of the Humoral Pathology was not founded upon sufficient grounds, the opinion respecting the operation of medicines was likewise called in question : From remarking that certain powerful substances exerted their effects so speedily, that it could not possibly be supposed they were carried into the circulation, many philosophers were led to search for some other mode in which medicines operated. They founded their rejection of the old opinion principally upon two circumstances, viz. that they were not able to discover, in any part of the course of the circulation, active substances which had been taken into the stomach ; and that any fluid, even milk, which is the most assimilated to the blood, when injected into the veins of a living animal, produced

sudden death. They asserted that the mutative power of the chylopoietic viscera was such, that every thing noxious was rejected, and only the nutritious parts of substances were permitted to pass into the sanguiferous system. Finally, they referred all the phenomena, which were inexplicable to them, to a certain vague term called sympathy; which, perhaps, involves as many or more difficulties than the former opinion. It is not pretended to be denied, that in the operation of certain medicines a sympathy does appear to exist between certain parts of the body; but it also seems probable, that this sympathy has had too great a latitude; and that certain circumstances are referred to it, which are more easily explained on other principles. Many respectable inquirers continue to entertain the idea that some substances are found in their active state after having entered into the circulation; and of consequence that they must have passed unchanged, or if changed, have regained their original properties by some process unknown to us. They grounded their opinion upon experiments and observations made with accuracy and fidelity: the accounts of these are to be found in various writings from ancient down to modern date: but, so far as is known to the author, there has been no compilation or collection of them into one mass. As the only way to arrive at the knowledge of the truth is to possess a clear view of the evidence, and as this question is deemed of some importance; it is contemplated in the following essay.

to exhibit to the reader a brief sketch of the arguments in favour of the opinion, that substances are found in their active state after having entered the circulation.

The subject is divided into three sections.

In the first I shall endeavour to shew that the question is not a of trivial nature, or interesting only as a matter of curiosity ; but that it is of much importance and practical utility. In the second section will be given, in support of the opinion adopted, the proofs as they appear in the fluid parts of the body. In the third, the proofs as they appear in the solid parts,

A N
INAUGURAL DISSERTATION, &c.

S E C T I O N I.

Of the Importance of the Question.

THE present question is not merely of a speculative nature, interesting only to the curious observer, and not to the practical physician. It embraces a wider scope, and the determination of it will be of essential importance in many cases that fall under our notice. A superficial view of the subject may induce us to suppose, that it cannot be of any real utility; but by the reflecting enquirer, a different opinion will be formed. In endeavouring to investigate a question of this nature, we ought to discard the ingenious subtleties of metaphysical reasoning, which often confuse, while they do not convict. Our data should be facts well authenticated, from which we are to draw fair and just conclusions. Taking truth for our guide, and not suffering ourselves to be warped by a prejudice for any particular opinion or theory, however plausible, we shall most probably accomplish the object of our pursuit. It is to be observed, that the ancients were strongly impressed with the idea, that

certain substances were conveyed, with little or no change of their properties, into the circulation. Hence they prescribed in certain diseases, the milk of animals, which had fed upon peculiar vegetables proper for those diseases. We know that milk constitutes a considerable portion of the aliment of man, in almost every part of the globe. Some nations, as the Laplanders, have scarcely any other subsistence, during one season of the year. If certain active substances are conveyed into it unchanged, it must surely be of importance to ascertain these; as their introduction into the body, at some periods of life, and in certain states of the system, may be productive of pernicious consequences. In like manner, much advantage may result, from introducing into the diseased system, in this way, medicines which could not be administered in any other. Subsequent facts will tend to prove, that very destructive habits may be thus acquired. An inattention to diet in a nurse, is often the unsuspected cause of distressing complaints in the sucking child. Active medicines, taken into the circulating fluids of a nurse, will affect the child in an alarming manner. Instances of this kind are not rare. If by the collection of facts on this subject, any hints may be given, which may lead to the discovery of a solvent of urinary or biliary calculi, it would be of essential service to mankind. That this idea is not visionary or impracticable, will be allowed by those who have investigated this subject.

with attention. Although disappointment may be frequently the reward of our exertions, yet by persevering industry, we often accomplish our undertakings.

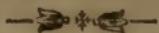
It has generally been supposed, that the preparations of lead, externally applied, are innocent, and under some circumstances salutary. But if cases occur, in which it is absorbed into the system, producing mischievous effects, it is surely of importance to keep these in view, in using lead. We may thus account for anomalous symptoms, which cannot be satisfactorily explained in any other manner. By knowing the cause of an evil, we may often remove the effect. On the contrary, the physician, who rejects entirely this opinion, will be perplexed about the situation of his patient; and by not removing the source, will aggravate the disease.

If it is discovered that certain medicines, by being externally applied, will be conveyed through the medium of the circulation, to different parts of the system, and produce the same effects as when taken internally; will not this discovery be of considerable importance in peculiar habits, and in diseases which will not admit of the internal use of medicines? Facts, to be related hereafter, will at least render this supposition probable.

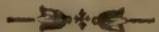
If it be ascertained, that while most substances are animalized by the chyliform process, and rendered subservient to the nutrition of man, others are conveyed into the circulation unchanged; it is

surely of importance to inquire what are these substances, and in what circumstances they are peculiarly injurious.

These remarks, it is hoped, are sufficient to excite the attention of the medical philosopher, and to convince him, that the question proposed for consideration, is not one of mere curiosity, but of real practical utility.



SECTION II.



Of the proofs, that substances are found in their active state after having entered the circulation, as they appear in the fluids.

NOTWITHSTANDING what has been asserted respecting the wonderful mutative power of the chyliform process, there are numerous instances of substances, after having entered the circulation through the lacteals, being found in their original state in the different fluids of the body. We are likewise possessed of cases where substances, conveyed by external absorption through the lymphatics into the circulation, manifested their obvious properties: To place the facts in the clearest point of view, it is thought proper to arrange them as they respect.

the chyle, blood, milk, saliva, urine, perspiration, &c.

I. Chyle. The opinion, that substances suffered a change of their properties before they entered the lacteals, was principally founded upon the celebrated experiment of Dr. Wright. It was made with the view of ascertaining whether chalybeates entered the blood. The experiment was this;—having kept a dog fasting sixty-six hours, he forced him to swallow a quantity of bread and milk, with which a portion of sulphate of iron was mixed: he opened him in an hour afterwards and collected some chyle from the thoracic duct, the colour of which was not changed by dropping the tincture of gall into it; although this tincture changed the colour to a deep purple when $\frac{1}{4}$ grain of sulphate of iron was dissolved in it.* From this the conclusion was drawn, that the lacteals had the power of rejecting chalybeates. On this experiment Dr. Percival observes “that it only evinces that the iron did not subsist in the chyle as a vitriol, qualified to strike a black colour with gall; neither does the calx of iron, nor the glass of iron possess this power; yet, though changed, they are both capable of being restored to it: perhaps with equal reason it might be presumed by one, ignorant of chemistry, that sal-martis contains no iron, because it is not acted upon by the load-stone.” But there are experiments, which directly oppose

* Philosophical Transactions, vol. I, part 2, page 295.

that of Dr. Wright, and from which very different conclusions must be drawn. Dr. Musgrave injected solutions of indigo and of stone-blue* into the small intestines of dogs, which he had kept fasting for a considerable time. On opening the dogs some hours after, he discovered that the lacteals and also the thoracic duct were coloured with the injections.† “A great many substances may enter the lacteals along with the chyle, even solids reduced to fine powder. When indigo has been thrown into the intestines of a sheep, I have seen the chyle rendered quite blue: now indigo is not soluble in water, but is a solid reduced into a very fine powder. So musk gets into the chyle, giving it a strong smell, and a great variety of other substances of various colours, various tastes, and various smells, each of them giving colour, or taste, or smell to the chyle.”‡

II. Blood. It is asserted that foreign matters cannot be conveyed into the blood in their active state, for that such a mild fluid as milk, infused into it, produces death: granting for a moment that this is the fact, we may however observe that the case is different where substances are immediately introduced into

* “ Stone-blue is a preparation of cobalt, pot-ash, and white lead; which, being converted into glass, is ground into a fine powder.”

PERCIVAL.

† Philosophical Transactions abridged. Chap. 4. Part 2. p. 76.

‡ Fordyce on digestion.

the blood vessels, and when they pass through the common routine of the circulation : we may observe further, “ that what passes by the lacteals or “ lymphatics is carried into the thoracic duct, and “ there mixed with a large portion of the chyle and “ lymph, by which its acrimony is sheathed and di-“ luted, or its chemical properties changed before it “ enters the mass of blood.”* We are informed of cases, where foreign matters were actually seen floating in the blood. An instance is recorded of a milky discharge from the groin of a boy, which recurred several times and continued several days each time :* The chyle does not immediately become assimilated with the mass of blood, but floats in it for some time in its original state : The following instance is in point. “ A maid, after eating a good “ breakfast about seven in the morning, was let “ blood about eleven the same day in her foot. “ The first blood was received in a porrenger, and “ within a little while it turned very white. The “ last blood was received in a fawcer, which turned “ white immediately like the white of a custard. “ Within five or six hours after, I chanced to see “ both ; and that in the porrenger was half blood “ and half chyle, swimming upon it like a serum as “ white as milk ; and that in the fawcer all chyle, “ without the least appearance of a drop of blood. “ And when we heated them distinctly over a gen-

* Percival. *Essay on the operation of medicines.*

† *Edinburgh Medical Essays.* Vol. 5.

" the fire, they both hardened as the white of an
 " egg when it is heated, or just as the serum of the
 " blood doth with heating, but far more white.
 " This maid was then in good health, and only let
 " blood; because she never had her courses, yet of
 " a very florid clear complexion."*

Experiments prove moreover, that the injection of medicines into the veins, is not necessarily fatal; but that administered in this way, they often produce their effects as certainly as when given in the ordinary manner. Thus we are informed by Haller,† that a poison or medicine injected into a vein, will produce certain determinate effects, as vomiting in the stomach, purging in the intestines, and drunkenness in the brain. Wahrendorf, in a village of Lusatia, injected wine into the veins of dogs, and remarked that it made them drunk. A solution of opium, injected into the veins, exerts its narcotic power even for two days. Vinous medicines, similar to opium in their intoxicating power, produced similar effects on living animals. Poisons, infused into the veins, exert a specific effect upon the different viscera. Certain emetics, administered in this way, excite vomiting in the same manner as if taken by the mouth. Borrichius asserts, that the same dose of medicine, which, taken by the mouth, purges, will produce a similar effect if infused into the veins. Many others

* Lower. Tractatus de Corde, &c. † Elem. Physiolog. vol. I.

relate similar cases. Diuretic medicines, infused into the veins, are carried to the urinary organs, and produce the same effects as when swallowed. Two drams of the tincture of cantharides, injected into the veins of a dog, excited a most copious flow of urine, eroded his bladder and destroyed him in the second experiment. Nitre, introduced in this manner, excited a copious flow of urine, without any ill consequences. Eight or nine drops of spirit of tobacco, injected into a vein, produced vomiting and great distress. There are instances of the salutary effects of medicines, exhibited in this manner, in diseases affecting the constitution. Purmann, a celebrated surgeon, cured himself of a cutaneous eruption, by injecting into his veins an infusion of cochlearia with spirits of theriacalis. We have instances related of syphilis, cured by medicines introduced into the veins. And we read of a man, labouring under the most dangerous symptoms from the bite of a viper, being cured by spirits of harts-horn injected into his veins.

“ We have injected by a syphon about two drams “ of a laxative medicine into the median vein of “ the right arm of three patients in the Hospital at “ Dantzick. One of the patients was a lusty, ro- “ bust soldier. He, when the purgative liquor was “ infused into him, complained of great pains in “ his elbow ; and the little valves of his arm did “ swell so visibly, that it was necessary by a gentle “ compression of one’s finger to stroak up that

“ swelling towards the patient’s shoulder. Some
 “ four hours after it began to work, not very trou-
 “ blesome, and so it did the next day insomuch
 “ that the man had five good stools after it.

“ The two other trials were made upon the other
 “ sex. A married woman of 35 and a serving
 “ maid of 20 years of age, had been both of them
 “ from their birth very grievously afflicted with epi-
 “ leptic fits, so that there were little hopes left to
 “ cure them. They both underwent this operation,
 “ and there was injected into their veins a laxative
 “ rosin dissolved in anti-epileptical spirit. The first
 “ of these had gentle stools some hours after the
 “ injection and the next day; the fits, recurring
 “ now and then, but much milder, are since al-
 “ together vanished. As for the other, viz. the
 “ maid, she went the same day to stool four times
 “ and several times the next; but by going into
 “ the air and taking cold and not observing any
 “ diet, she cast herself away.

“ Mr. Smith hath ventured to open a vein and
 “ infuse some medicines into the blood of two per-
 “ sons, in the hospital of Dantzick, desperately in-
 “ fected with the pox, whereof the one recovered
 “ and the other died.”*

If credit be due to these facts, we cannot hesi-
 tate in believing that active substances may mix with
 the blood in their original state. We must also
 grant, that so far from being productive of any ill

* Philosophical Transactions abridged. Vol. III. p. 234.

consequences, they may be subservient to beneficial views. It is not probable however that this mode of exhibiting medicines will ever be brought into general practice, as there is some inconvenience attending it, and as it is seldom or ever necessary. The examples are cited only to confirm the justness of the general principle, that active substances may enter the circulation with impunity.

Several additional arguments may be adduced in support of what has been already advanced. Thus, it is asserted by Mr. Bell and others, that mercury cures lues venerea by mixing with, in the blood and neutralizing it. "Mercury will pass into the system in various forms from the surface of the body. Lues venerea has been cured by frequent immersions of the feet and legs in a solution of corrosive sublimate. The application of a mercurial plaster to the surface of the body, if of any considerable extent, will also cure the disease."†

If the poison of contagious diseases can circulate in the sanguiferous system without injury, why may not medicines, which are not more active, also pass into the system with impunity? It is well known that the lues venerea is communicated from the mother to the foetus in utero. Some cases of the small-pox being communicated in like manner have occurred. Mr. Turnbull relates the case of a lady, who was inoculated in the seventh month of her pregnancy. Nine days after the eruption she

† Bell on Lues venerea. Chap. 4. Sect. 4.

received a fall, and in a few days after that was delivered of a dead child, which was covered with variolous pustules in a state of suppuration. The matter was proved to be variolous from its communicating the disease to several persons who were inoculated with it.†

It has been denied by some that variolous matter could enter the blood in its active state; but this and other instances convince us that it can. We should therefore be cautious in inoculating pregnant women, as we may sometimes unintentionally destroy their embryo offspring.

Some cases are mentioned where the small-pox was communicated by variolous matter introduced into the stomach.‡ In these there can be no doubt that the matter was taken into the circulation in its active state in order to produce the eruption.

In a pregnant woman, who had used a considerable quantity of saffron, the liquor amnii is said to have been tinged of a saffron colour.§

The fact being ascertained, that active substances can enter the circulation and produce their specific operation on different parts of the body, according to the different qualities which they possess; we have a clue afforded to extricate us from the labyrinth, in which we have been wandering. Certain pheno-

† Memoirs of London Med. Soc. Vol. IV. p. 364.

‡ Medical Repository. Vol. I. p. 258.

§ Haller. Elements of Physiology. Vol VIII. de Fetu.

mena, which have been hitherto shrouded under the dark veil of sympathy, are more easily explicable, it is conceived, by the opinion we advocate.

Tobacco beaten up into a poultice with vinegar or brandy and applied to the stomach, produces violent vomiting, and is very effectual in removing hard tumours of the hypochondria. Groundsel beaten down to a pulp and applied to the stomach, produces vomiting and cures agues.†

Oil of tobacco, dropped upon the tongue of a cat, impregnated the whole of the animal with its odour. The decoction of this plant, when the head was washed with it, caused vomiting, fainting, and convulsions—applied to the belly, it produced vomiting and intoxication—the oil in the form of ointment produced purging—the roots of white hellebore applied to the stomach, occasion vomiting. Bitter medicines applied externally to the abdomen, destroy worms. Crocus metallorum, applied externally to cure a herpetic eruption, produced vomiting.‡

The experiments of Mr. Sherwen would lead us to conclude that tart. emet. externally applied, is taken up by the absorbents and conveyed through the medium of the circulation to the stomach. Five grains of tart. emet. rubbed into the palms of the hands, in six hours produced a slight nausea, burn-

† Edinburgh Medical Essays. Vol. II.

‡ Haller. Elements of Physiology. Vol. V.

ing of the skin and increased perspiration. A larger quantity, rubbed into the hands and wrists, produced, in a few hours after, a sickness, brisk evacuation by stool, and an increased flow of urine for several days. In one case, the medicine, after producing slight nausea and gentle catharsis, was succeeded in two or three days by a rash with a considerable itching all over the skin, which continued some days. In a case, where disagreeable symptoms had succeeded the drying up of an old ulcer in the leg, tart. emet. administered in this way produced nausea, profuse perspiration, and a discharge from the ulcer, by which all the symptoms were relieved. Experiments with arsenic, made in the same manner as with tart. emet. prove, that it occasions slight nausea and increased flow of urine.* The dangerous properties of arsenic have hitherto intimidated practitioners from an extensive use of it internally. If therefore experiments of this kind should lead us to discover that arsenic, externally applied, is conveyed into the system, and is a safe and efficacious diuretic, we shall add a new weapon to our store for combating the dreadful disease of dropsy.

Certain Italian physicians have instituted experiments on this subject, the result of which would appear to favour our doctrine. A woman, having violent pains, and refusing to take opium by the mouth, was a fit subject for experiment. Dr. Charenti dissolved three grains of pure opium in two

* Medical memoirs. Vol. II.

scruples of the gastric juice of a crow ; and after suffering it to remain at rest some hours, he mixed it with simple ointment and rubbed it on the backs of her feet. In an hour the pains were wholly removed, and did not again return. Squills and fox-glove were used in the same manner with equal success. It appears, from experiment, that the application of these substances was most successful, when they were dissolved in gastric juice or saliva.

“ Dr. Ballerini, of Mantua, cured one dropfy “ with frictions of six grains of squills, dissolved in “ gastric juice, made every second evening ; and “ another with one scruple of squills, dissolved in “ one dram of saliva, rubbed in at three times dur- “ ing the course of the day. The assistants, who “ made the frictions, had likewise an increased flow “ of urine.”

Professor Brera used opium, in this manner, with success in chlorosis; also squills, digitalis purpurea, corros. sublim. aconite, and tart. emet. in other diseases. From his observations he concludes, “ That “ every animalised fluid is fitted by nature to ren- “ der remedies capable of being absorbed.”*

We have numerous instances of the unhappy consequences attending the introduction of lead into the system, which are perhaps more rationally explained on this principle than on any other.

Litharge carried under the arm-pits caused dyspænia, fainting, nausea, vomiting, &c. Cerusse applied

* Annals of Medicine, Vol. III.

to a part that had been chafed produced similar effects.* The immoderate use of the saturnine lotion for six days to a leg and foot, from which the cuticle had been stripped, produced colic, trembling of the limbs, continual nausea and frequent vomitings.†

The application of Goulard's poultice to the knee, continued for some time, produced a violent pain in the bowels, which did not cease until the removal of the poultice. Instances have occurred of convulsions being produced in children by cerusse sprinkled on excoriated parts. It is not improbable that litharge, the common basis of plaisters, when employed in dressing issues, produces some of the common effects of the preparations of lead taken internally.‡

Dr. Baker observes "that he met with a most violent and obstinate colic, which seemed to have been occasioned by some litharge mixed in a cataplasm, and applied to the vagina with a view to allay a troublesome itching."

The vapour of lead, which exhales when it is melted, will excite colica pictonum, as in the case of plumbers and potters, and those who make shot. This vapour, when the metal is heated by mere friction, will produce this colic, with all its terrible consequences.§

" We want no authorities to testify, that the too fashionable application of cerusse to the skin,

* Haller. *Elenca. Physiolog.* vol. V. † *Percival's Essay on the poison of lead.*

‡ *Medical Transact.* vol. I. § *Med. Transact.* Vol. I.

“ has been followed by obstinate colics, pains,
 “ tremors and resolution of the limbs, slow wasting
 “ fevers and a pulmonary consumption. For such
 “ frequently has been the fate of those, who have
 “ thus endeavoured to supply the defects of their
 “ persons, by a vain and temporary imitation of
 “ beauty.”*

“ The vinegar of lead, diluted and rubbed upon
 “ the skin, cures breakings out, redness, inflam-
 “ mations, and the erysipelas; it gives a whiteness
 “ and beauty to the skin, but proves pernicious
 “ to the body; at length occasioning a consump-
 “ tion, as appears by many melancholy exam-
 “ ples.”†

The ung. saturnin. applied for ten days to parts, from which the cuticle had been removed, occasioned a severe colic, resembling in many of its symptoms, the colica pictonum. A gentleman, having strained the tendo achillis of each leg, was advised to use a bath of vegeto-mineral water. The bath was so constructed, that he could immerse his legs to the height of the calves. He used it for five or six minutes every morning and evening for a week, when he was obliged to desist, from the violent spasmodic and paralytic affections it occasioned; nor did he recover from them for some time.‡

* Baker. † Boerhaave. Elem. Chem. Vol. II. process 172.

‡ Med. Transact. Vol. III.

There is an instance upon record, of a palsey of both legs and arms, being induced by the application of *sacch. saturni.* to venereal warts, for the purpose of destroying them.*

" A gentleman, who had for many years had a fontinel, finding that the pea was not sufficiently depressed for two or three years past, applied occasionally, a piece of the thinnest lead over the oil-skin which covered the pea. This apparently answering the purpose, the oil-skin was by degrees omitted; so that the lead was generally in immediate contact with the pea and the orifice of the fontinel. " *Med. Transact.*

" This was the case about the end of June, 1771; when an uneasiness and oppression, were felt at the præcordia and diaphragm, with anxiety and difficulty on making a deep inspiration. The disorder, daily increasing, became, towards the end of July, so grievous as to require the serious attention of the person afflicted. On recollection, he began to suspect, that his complaints might be owing to the noxious quality of the lead, which covered the fontinel. He therefore immediately threw it off; and from that time, without the use of any medicines, the disorder very soon abated, and in about one month was entirely removed; nor has it in any degree returned." §

* *Med. Transact.* Vol. II. § *Baker on the poison of lead.*

The inferences to be drawn from the abovementioned facts, must be sufficiently obvious to the candid observer. If we take into consideration the various circumstances attending the external application of lead in these cases, some light may be thrown upon the subject. It was necessary for a certain portion of time to elapse before the poison manifested its effects. If it operated by sympathy, the effect should be instantaneous, as we know to be in other cases where the phenomena are referred to an unknown sympathy. But as we find that a space of time, sufficient for the introduction and diffusion of the poison in the circulation, must intervene before its effects are perceived, we have a right to suppose that it does enter the circulation, and thus produces its mischievous consequences. The symptoms attending, coincide so exactly with those which succeed the internal use of lead, that they afford strong reason to believe the poison acts immediately upon the parts affected. This can only be effected by its entering into the circulation in its active state.

The dangerous consequences, which sometimes result from the external use of the preparations of lead, under certain circumstances, should teach us caution in the management of this metal. This appears to be more especially necessary in cases where the parts have been excoriated, as in those situations the absorbents seem to be peculiarly active. The pernicious practice of applying to the skin pigments,

of which lead is a constituent part, cannot be too strongly reprobated. By diminishing the sense of the danger, we encourage the growth of the evil. It is only by inculcating the opinion, that the poison of lead may be absorbed into the circulation, and thus be productive of the most dreadful consequences, that we can hope to arrest this destructive fashion. Mercury is often adulterated with lead, and its use is sometimes attended with the peculiar effects, which succeed the use of the preparations of lead. It is therefore of some consequence to keep this circumstance in our remembrance, when we are exhibiting mercury.†

Observation would lead us to suppose, that lead internally used, passes into the circulation in its active state. Is not this supposition rendered probable from the palsies of the limbs, which succeed colicatotonum? Here is an affection of parts distant from those to which the poison is directly applied. Colics, which arise from other causes, are not attended with similar consequences. Is not the supposition further strengthened by the fact, ascertained from Mr. Hunter's experiments, that the application of *sacch. saturni.* to the muscles of dogs, produced in them the same appearance which is exhibited by the muscles of painters labouring under paraly sis? Sour wines sweetened with lead have produced many unhappy consequences of this kind. It is known that

† Baker on the poison of lead.

Facch. saturni. will render gin, which has a yellow tinge of a beautiful transparent whiteness. This iniquitous process has been too frequently the unsuspected cause of many distressing symptoms. The honey extracted by bees from the *kalmia latifolia*, (bastard laurel) and some other poisonous plants, has the remarkable property of proving errhine, after it has been taken into the stomach some time. It produces sneezing occasionally for two or three days afterwards.* The powder of the different parts of the *kalmia latifolia* is considerably errhine.† How can we account for this strange effect, but by supposing that the honey is taken into the mass of blood and that it continues to circulate in its active state for some days?

From what has been said concerning the proofs of the opinion, which is maintained in this essay, as they appear in the blood, we learn in the first place, that active substances, directly mixed with the blood, are not necessarily fatal, but sometimes salutary. Secondly, knowing this fact, we can more easily explain on this principle than on any other, certain phenomena resulting from the external application of medicines. Thirdly, circumstances attending the internal exhibition of some medicines, are most easily accounted for by this opinion.

* Barton's lectures on *materia medica*.

† *Essay towards a materia medica of the United States.*

III. Milk. Certain substances manifest their presence in the milk by their colour, taste, smell or peculiar effects.

Milk is faintly tinged of a red colour from eating the Indian fig, and also from madder: it assumes a blue colour from the use of indigo.†

Saffron imparts its colour to the milk of women using it.‡

The sugar of milk depends upon the quantity of sugar contained in the aliment which is used. Its acescency is supposed to proceed from the use of vegetable aliment. Cows, fed upon certain vegetables, give milk of a colour and taste similar to those vegetables, as the horse-chesnut, madder, &c. All the filiquosa communicate a peculiar taste and odour to the milk of animals feeding on them.§

It is a fact very generally known, that where animals feed upon garlic, pepper-graſs, salt-marsh, &c. their milk, and the butter obtained from it, partake of the taste and smell of the substance used.

Animals, feeding on a certain species of gentian, have their milk, and the cheese made from it, of a bitter taste. We may discover in milk both the smell and taste of the strong treacle-mustard, and also of saffron. The bitterness of wormwood and the smell of thyme are often perceptible in milk.||

† Haller, Elem. Physiolog. Vol. VII. de lacte.

‡ Ferris on milk.

§ Barton's Lectures on Materia Medica.

|| Haller. Elemen. Physiolog. Vol. VII.

The peculiar effects produced by the milk of animals, which have fed upon particular plants, evince that the active matter is carried into the circulation, and retains its properties even in the secreted fluids.

A case is related by Dr. Cooper, of a woman who was salivated, producing the same affection in a child sucking her. Gmelin asserts that the milk of salivated animals will salivate a child. Dr. Hamilton detected globules of mercury in the milk of a salivated woman, by slow evaporation.†

The properties of spurge have manifested themselves even in cheese; the eating of such cheese having occasioned dangerous vomiting and purging. The milk of cows, which feed on the hedge hyssop, is purgative. A nurse having taken a purgative medicine and afterwards suckling a child, a hypercatharsis was induced on the child; but the nurse felt no ill effects from the medicine. A boy, who was sucking a nurse that had drunk spirituous liquor, was thrown into violent convulsions.‡ Infants, from being suckled by drunken nurses, have contracted a propensity for strong drink.§ A child was intoxicated by the milk of a nurse, who had taken a considerable quantity of opium.||

The ancients were so strongly persuaded that substances were taken into the circulation in their

† Barton's Lectures on Materia Medica.

‡ Haller. Elem. Physiol. Vol. VII.

§ Ferris on milk.

|| Barton's Lectures on Materia Medica.

active state, that in certain diseases they prescribed the milk of animals which had fed on vegetables proper for the cure of those diseases.*

The milk of goats, which have fed on astringent and balsamic herbs, is recommended as an excellent remedy in certain species of diarrhæa. Thus also the properties of pellitory, madder, the lesser nettle, lettuce, purslain, on which cows have fed, are carried into the milk so unchanged, that they produce their usual effect in the sick who use this milk.†

Some modern writers also entertain the opinion, that the active properties of substances are found in the milk. The celebrity of these writers cannot fail to give additional support to the opinion. A nurse, by eating of cabbage, or of other flatulent vegetables, always gave her sucking child the windy gripes.‡ To prevent the belly-ach, which is so frequent among sucking children, their nurses should be careful to avoid eating vegetable food.§ In cholera infantum, when the child is reduced so low in the latter stage of the disease that it cannot swallow cordial medicines; if it be sucking, the medicines are to be administered to the nurse, and they will in this way enter the system of the child.|| These observations teach us a new mode of exhibiting medicines, from the proper management of which much advantage may be derived. In consti-

* Ferris on milk. † Haller. Elem. Phisiol. Vol. VII.

‡ Percival's Essays. Vol. I. p. 168. § Rush's Lectures.

|| Rush's Lectures.

tutions, where peculiar circumstances render the direct application of remedies improper, we may perhaps administer medicated milk with essential benefit. In cases where it is necessary that medicines should be exhibited for a long time, gradually, and in small quantity, no more agreeable mode could be discovered. The facts that have been related clearly prove, that the active properties of some substances are found in milk ; and it is at least worth the trial, to endeavour to apply this principle to some useful purpose.

IV. Saliva. Some proofs may be adduced, which appear in the saliva. The property of exciting an increased flow from the salivary glands, which is manifested by certain substances, some time after they have been taken internally or applied to the external surface, is only to be explained by supposing that these substances are conveyed in their active state, through the medium of the circulation to the parts affected.

A partial and temporary salivation may be produced by topical stimulants applied to the glands. This ceases shortly after the irritant, which excited it, is removed from the mouth, and may be referred wholly to the direct external application of stimulus. But the salivation, occasioned by mercury, and some other articles, remains long after their use has been relinquished, and can only be accounted for on the principle we have adopted.

Mercury is taken into the circulation in many cases, especially where it excites salivation. It reaches and acts upon the organs of perspiration. The long continued use of it, produces an inflammatory crust upon the blood. Certain preparations of antimony, also salivate; and the same effect is produced by oxygen gas, nitric acid, citric acid and polygala Seneka, &c.*

Lead, used internally, has been known to salivate. In the case of Professor Thunberg, related by himself, it is observed, that in eight days after the salivation commenced, lead was perceived in the saliva.† The oil of the melaleuca leucadendron, rubbed upon the soles of the feet, manifested its taste in the mouth. Petroleum, dropped upon the head, discovered its taste in the mouth.‡

V. Urine. The facts, which are related respecting the presence of substances in their original state, in the urine, are so numerous and well authenticated, that none will hesitate in giving his assent to them. Certain articles impart to the urine, their colour, taste, smell, or imbue it with their peculiar properties.

“ Extract of logwood, taken internally, sometimes gives a bloody hue to the urine.” Its astringent property, often accompanies its colouring matter.§ Persons eating the Indian fig, have

* Barton’s lectures on *materia medica*.

† Voyage to the Cape of Good-Hope, Vol. I.

‡ Haller. *Elem. Physiolog.* Vol V.

§ Percival’s *Essays*.

their urine of a blood colour; the same takes place from eating red beets, or madder. It becomes blue from indigo. Asparagus and olives, communicate a strong smell to it. Turpentine gives it a violet smell. It is also scented by nutmegs, mace, cloves, juniper, parsley-roots, fennel, carrot, parsneps. It is made bitter by balsam copaibæ. Vinous spirits are sometimes found in the urine; also oil shortly after it has been taken in. A certain species of mushroom, possessing an intoxicating property, is found to retain this property, after passing into the urine.*

Rhubarb, taken into the stomach, colours the urine for many hours after. It is said to possess a diuretic property. The oil of savin sometimes exerts diuretic effects upon the kidneys, and in these cases the urine is impregnated with its smell.† Nitre, taken internally, is found in the urine in its native state. When applied to the external surface of the body, it is taken up by the absorbents and conveyed through the medium of the circulation into the bladder, unchanged. A solution of nitre, applied in a pediluvium, is said to have been absorbed into the circulation; for a piece of paper, dipped in the urine and dried, burnt in the same manner as touch-paper.‡

* Haller. *Elem. Physiolog.* Vol. VII. *de Urinæ.*

† Barton's lectures on *materia medica.*

‡ *Zoonomia.* Vol. III. p. 361.

Turpentine acts as a diuretic; when taken in large doses it produces stranguary, diabetes, &c. and hence we infer that it has a peculiar action on the kidneys. Whether applied externally or internally it discovers its smell in the urine. We have a proof that it is taken into the circulation and carried to the bladder, from its correcting the peculiar smell which is observed in the urine of persons who have eaten of asparagus.*

Kaauw Boerhaave relates, that a man, holding turpentine in his hands for some time, perceived in his urine the same violet smell, which is observed when turpentine has been taken into the stomach.†

This fact is familiar to anatomists, who are in the habit of injecting dead bodies and washing their hands with spirits of turpentine.

The different species of garlic appear to pass into the circulation, particularly affecting the urinary system, and sometimes discovering their smell in the urine and perspiration. From their supposed property of passing into the urine unchanged, they have been recommended as lithontriptics. Some of the siliquosa are used in drop-sy, with advantage. Their active matter is probably carried into the circulation and thus to the kidneys, occasioning heat of urine, &c.‡

* Barton's lectures on *materia medica*.

† *De Perspiratione.* No. 430.

‡ Barton's lectures on *materia medica*.

It is supposed that the strangury, which sometimes succeeds the external application of cantharides, is occasioned by the absorption and internal stimulus of them. This opinion is supported by the following observations :

1. "Neither mustard, the actual or potential cautery, nor any other vesicating stimulus, but cantharides, excite this complaint."
2. "Drinking plentifully prevents the strangury, by diluting in the kidneys and bladder the acrimonious particles of the cantharides."
3. "A blister, laid upon the head immediately after shaving, is almost always succeeded by the strangury; whereas no such effect takes place, if the application be delayed twenty-four hours."†

The effects produced by certain medicines, which have been used as lithontriptics, render it probable that they are conveyed into the urine, unchanged. From the remarkable effects produced by uva ursi in nephritis, have we not a right to suppose that it is conveyed into the circulation unchanged? The acid liquor, which is obtained from uva ursi, attacks human calculi, diminishes them and softens the parts which it cannot dissolve. Nor was there one, among one hundred and fifty calculi, which it could not dissolve. It is not probable that its powers are lost, when it is given internally; for when mixed with blood and bile it still retained its solvent

† Percival's Essay on blisters.

property. It appears to abstract the mucus from the calculus, to loosen the connecting medium of the earth which composes it, and to diminish the whole stone by dissolving a part and softening the remainder which was insoluble.*

The carbonate of soda is equally efficacious in alleviating the distressing symptoms of nephritis, and in causing large quantities of gravel to pass off by urine. "The stones voided appeared half dissolved, " which before had been hard and rough, and when "dry seemed to be covered with a fine soft powder. The use of this medicine produced "a large mucous and very ropy sediment in the urine "and a great abatement of pain." This medicine has also given great relief in biliary calculi of long standing.† Fixed air is asserted to be lithontriptic. Doctor Percival informs us, that an eminent physician in London has been successful in the use of it, "having brought away in small fragments, " and in a whitish chalk-like substance, a stone "from the urinary bladder, by administering fixed "air to his patient during the space of a few "weeks."‡ Several respectable authorities have adopted the opinion, that fixed air may be conveyed unchanged into the bladder. Although it may be doubted whether fixed air can be conveyed through the circulation into the bladder; yet it appears from experiment that from a certain quantity of fresh made urine, one fifth of its bulk of pure

* Haller. Histor. Stirp. Indigen. Helvet. Vol. I.

† Beddoes. ‡ Percival.

fixed air was obtained. Drinking water containing this air may impregnate the urine with it, and make it more efficacious in dissolving calcareous matters than it would otherwise be.*

The drinking of waters impregnated with fixed air is recommended and extolled by Hoffman and others, as very efficacious in preventing and dissolving calculi. Human calculi, by being macerated in these waters, were considerably diminished. They are also diminished by immersion in the urine of those persons, who had drunk water impregnated with fixed air; while the urine of a person in health, not using such water, had no effect in lessening their bulk.†

From this fact the inference must certainly be drawn, that fixed air is conveyed unchanged into the urine.

Doctor Sydenham entertained the idea that malt liquors alleviated the pain and irritation arising from gravel. In his own case, he observes, that whenever he was obliged to ride over stones, it was his custom to take one or two large draughts of small beer, which prevented bloody urine.

Doctor Dobson observes, "that upon the whole
" the sedative and solvent powers of fixed air, in
" cases of the stone, are so far ascertained, as to
" give it a claim to the particular attention of the
" faculty. Further experience can alone determine

* Priestly on air Vol. II. page 216-17.

† Dobson on fixed air.

" whether, by the steady and long continued use of
 " this medicine, a cure may not in some instances
 " be happily effected."

It appears that the urine of persons, using alkaline remedies becomes alkaline, and that it exerts some degree of a solvent power upon urinary calculi immersed in it.*

Doctor Falconer speaks very highly of the use of the aqua mephitica alkalina, or solution of fixed alkaline salt, saturated with fixible air in calculous complaints. In the case of Mr. Colbourne, who had occasionally passed small stones and was much troubled with nephritic symptoms, he observes "that, during the use of the mephitic alkaline solution, he parted with no gravel, his urine deposited no sediment, whatever, or discoloured the vessel; though, if it was omitted even for a few days, these appearances took place and small bits of gravel were perceptible in his water." The use of this solution is observed to correct the foetor and dispositon in the urine to putrify, which manifested themselves previously to its use.† It is well known that fixed air will retard the putrefactive fermentation out of the body, and hence the foregoing fact furnishes us with an analogical argument that this air is conveyed into the bladder.

Human calculi, immersed in this solution, were found to lose a considerable part of their weight.

* Home's Clinical Experiments and Histories.

† Falconer on aqua mephit. alkal.

A daily portion of the urine of a person, who used the solution, was poured upon a fragment of a calculus for six months, at the end of which time it had lost two-thirds of its original weight. Upon another fragment of the same calculus, a daily portion of the urine of a person in health, not using the solution, was poured for two months, but did not exert any solvent effect.* Does not this prove that the solution is conveyed unchanged into the bladder? The preparations of some of the metals are found in the urine in their original state, as is discovered by the usual tests. "Iron appears to possess the property of passing into the circulation under the form of æthiops. The valuable experiments of Menghini, published in the memoirs of the institutes of Bologna, have proved that the blood of persons, who take martial remedies, is thicker and contains more iron. Mr. Lorry observed that the urine of a sick person, to whom he administered iron in a state of extreme division, was manifestly coloured with the nut-gall."†

From what has been related, respecting the presence of substances in the urine, it must be granted by all, that certain matters are found in this fluid in their original state.

It is, however, denied, by a celebrated and ingenious writer,‡ that active substances are conveyed

* Falconer.

† Chaptal's Elements of Chemistry, part iii. chap. x.

‡ Darwin,

through the course of the circulation into the bladder. He asserts that the lymphatic vessels of the bladder, communicating with the absorbents of the intestines, take on a retrograde action, and thus an easy and direct passage is made into the bladder. One of the principal arguments for this opinion rests upon the phenomena observed in diabetes. It is supposed that the immense quantity of urine, which is sometimes discharged in this disease, cannot be secreted by the kidneys, but must pass by some direct communication between the alimentary canal and the bladder. This opinion is said to be supported by the circumstances attending the drinking of mineral waters. It has been supposed that the short time, in which the flow of urine takes place after receiving these waters into the stomach, demonstrates the existence of some more direct route than through the ureters. "But in this case
" the stimulus of cold water received into the sto-
" mach, like external cold applied to the skin,
" causes a concussion of the bladder and urinary
" parts, by which they are solicited to repeated dis-
" charges of the old urine which was before in the
" body, and not immediately of that which was
" last drunk. Again, one thousand ounces of
" blood are conveyed through the kidneys in an
" hour, and this is surely sufficient to furnish twenty
" or even fifty ounces of urine. Finally, it is cer-
" tain that both men and brute animals perish, if

" the ureters are obstructed by a ligature or other-
" therwise. We then observe also that no urine
" can be found in the bladder."*

The limits of this essay will not allow a fuller investigation of the doctrine of the retrograde motion of the absorbent vessels; and the more especially as it is not strictly connected with the present subject of inquiry.

VI. Perspiration. Marks, that substances have entered the circulation in their active state, are sometimes found in the fluid excreted from the surface of the body.

Opium is absorbed into the blood-vessels. Haller asserts that the smell of opium is sometimes observed in the perspiration, particularly in his own case.†

The active property of camphor appears to reside in a volatile vapour; it is sometimes absorbed into the mass of blood, is known to salivate, and discovers its smell in the perspiration and sweat.‡

The common garlic and the red onion, when taken into the stomach pass off by perspiration, occasioning considerable thirst, &c. The smell of garlic is said to be perceived in issues, fistulæ, &c.§

It is probable that elixir vitriol is conveyed into the vascular system and excreted by the pores of the skin. It is said to perform a cure in nurses, who

* System of Anatomy, Vol. II. p 411.

† Barton's lectures on materia medica.

‡ Barton's Lectures on Materia Medica. § Ibidem.

are affected with the itch, and also in children sucking them. ^{* See the 2d. edit. of the original}

Dr. Russell remarks that the people of Aleppo, who take large quantities of oil internally, are found to have oil transuding through the pores of their skin. Oil obtained from the livers of cod-fish, administered internally in the Manchester hospital, manifested its nauseous taste and smell in the perspiration of those who used it. “An oil of the same kind forms no inconsiderable part of the food of many northern nations; and it is said to penetrate and imbue the deepest recesses of the body.” †

We have thus endeavoured to exhibit a comprehensive view of the proofs of the opinion, maintained in this essay, as they appear in the fluids. Considered individually they may not perhaps amount to demonstration, but taken collectively, it is presumed, they will make some impression upon the mind of the candid inquirer.

That medicines should be conveyed into the circulation unchanged, or, if decomposed, that they should be recomposed, is not more strange or unaccountable than that urine, semen, &c. should be secreted from the blood. Chemistry presents us with an analogy. We see, that by the union of two different substances, a third is produced differing in quality from either. By the addition of another substance we procure one of the first constituents in

* Percival's Essays.

† Ibidem.

its original form and properties; May not a process similar to this be carried on in the circulation? Much yet remains to be explored.

SECTION III.

Of the Proofs, as they appear in the Solids.

THE proofs that have been already adduced in support of the opinion, that certain substances enter the circulation in their active state, afford at least a high degree of probable evidence. We now come to consider the proofs, with which we meet in the solids. These, although few in number, are decisive, and must carry conviction to the lover of truth. They are arranged as they appear in the skin, flesh and bones.

I. Skin. Sulphur, after passing through the circulation and being conveyed to the skin, evidently recovers its original properties. It communicates its particular odour to the perspiration, and blackens silver, &c. A gentleman, who was in the habit of taking sulphur daily, perceived, after some time, that his silver knee-buckles were made black and also his watch.

It is observed, by Bishop Watson, that persons, using cosmetic lotions containing lead, and at the same time drinking sulphurated waters, will have

the parts, to which the lotions are applied, changed black.

"Dr. Swediaur relates the case of a Protestant minister, near Hamburg, who took, by the direction of an empiric, some nitrate of silver for an obstruction of the liver. After continuing this medicine for several months, his skin began to change gradually, till at last it became almost perfectly black. This colour lasted during several years, but is now wearing off."*

The active part of the diet of some animals, seems to enter into the course of the circulation, and to manifest itself perceptibly in their integuments. The Turkey-buzzard (*Vultur Aura* of Linnaeus) is a carnivorous bird, and feeds upon the putrid carcases of animals. The quills of these birds have generally such a stinking odour, that we are obliged to keep them a long time, before they become fit for use.†

II. Flesh. The active properties of certain substances, which are eaten by animals, are conveyed into the circulation in such an unchanged state, that the flesh of these animals will produce the same effect, as is produced by those substances. It is a fact, well known, that the flesh of wild pigeons, which have eaten the berries of the *phytolacca* or *poke root*, will purge, if a considerable quantity of it is taken into the stomach. The flesh

* La médecine éclairée par les sciences physiques, &c. Fourcroy.

† Barton's lectures on Natural History.

of pheasants, which have fed upon the *kalmia latifolia* or wild laurel, one of the most fatal poisons, has been known in several well authenticated instances, to exert deleterious effects, in a few hours after it has been taken into the stomach.*

Dr. Barton informs me, that he has been considerably purged by eating the flesh of deer, which had fed upon the leaves of the *kalmia latifolia*. Dogs, who had eaten the flesh, were affected with convulsions and paralysis of the hinder legs.

Kempfer (in his History of Japan) mentions a fish,† which being fed with a certain poisonous plant, is infected with its peculiar deleterious properties, and destroys the persons who eat of it.

The red sea-bream when found in the South Sea, salivates. This fish, taken in the Pacific and Atlantic Oceans, does not produce this effect. The peculiar property of salivating, is occasioned by its eating the medusa or sea-blubber, which is known to possess this property.‡

The balsam of the *populus balsamifera* (called balsam or tacamahaca tree) is so very penetrating, that it communicates its peculiar smell and taste, to the flesh of certain birds, which feed upon the buds.§ The onion has such a durable strong taste and smell, that it is perceived in the flesh of peacocks, who are fond of eating it.||

* Medical Repository. Vol. I. p. 161. † *Tetraodon ocellatus*.

‡ Cook's voyages.

§ Barton's Essay towards a Materia Medica of the United States.

|| Haller. Histor. Stirp. indigen. Helvet. Vol. II.

It is generally known, that the flesh of some animals, killed at a particular season of the year, is strongly tainted with garlic. This is particularly the case with sucking calves, who receive it through the medium of the milk. “The London mutton is known to taste strong of turnips, with which the sheep prepared for market are chiefly fed.”

The following fact is transcribed from an ancient book, in its original style and language.

“Here a multitude of the inhabitantes, as well women as men, resorted to hym (Columbus) with cheerefull countenaunce and without feare: bringynge with them popinjayes, breade, water and cunnyes. But especially stocke-doves muche bygger then owres: which, he affirmeth, in sa- voire and taste to be muche more pleasaunt then oure partryches. Wherefore, as in eatinge of them he perceaved a certyne favoure of spyce to proceade from them, he commaunded the Croppe to bee opened of such as were newely kylled, and fownde the same full of sweete spyces, whiche he argued to bee the cause of theyr strange taste. For it standeth with good reason, that the fleshe of Beastes shulde drawe the nature and qualitie of theyr accustomed nuryshemente.”*

Wormwood affects not only the milk, but also the flesh of animals, with its intense bitterness.†

* Translation of the Decades of Peter Martyr. Decad. I. p. 16-17. London Edition, 1555.

† Barton's Lectures on Materia Medica.

“ Our table was always plentifully and even luxuriously, furnished with truffles, red-legged partridges, and a great variety of small birds ; the latter were not indeed very palatable to us at first, on account of the high flavour of the juniper berries on which they fed.”*

Birds, which live wholly on fish, have their flesh to taste of fish. Mr. Hunter observes, “ this fact was so well known, that it was hardly necessary to put it to the test of an experiment. Yet he took two ducks, and fed one with barley, the other with sprats for about a month, and killed both at the same time ; when they were dressed, the one fed wholly with sprats was hardly eatable, it tasted so strongly of fish.”†

Let the candid reader weigh, with mature consideration, what has been said under this head, and then decide whether any doubt remains with him on this subject.

III. Bones. We meet with but few proofs, in the bones, of substances being conveyed into the circulation in their active state. Perhaps this is owing to want of attention. One solitary fact, however, would be more in point, than a thousand which are negative.

Mercury is received into the blood unchanged ; for it has been found fluid and in its native state, in the cells of the bones.‡

* Smith’s Tour. Vol. I. p. 146. † Animal Oeconomy. p. 177.

‡ Haller. Elementa Physiolog. Vol. VI.

It would appear that some substances, which lose their properties on entering the circulation, again acquire them after having passed through it. Thus madder does not tinge the skin, muscles, ligaments or fat, but when carried to the bones, it colours them.*

"The bones of the Canada porcupine, during winter, are of a greenish yellow, owing, as is supposed, to the bark of the pine on which the animal feeds in that season of the year."†

In the disease of rickets, which is supposed to be occasioned by a deficiency of bony matter, the exhibition of lime-water, both internally and in the form of bath, has been found exceedingly advantageous. May we not reasonably suppose that the lime is carried into the circulation and there, meeting with the phosphoric acid, supplies the bony matter where it is wanting?‡

Circumstances, unavoidable, do not permit the further investigation of the present interesting inquiry. I regret that the same circumstances prevented me from bestowing a longer and more minute attention upon this subject than I have done. The field is truly extensive, and patient, persevering labour may glean much valuable fruit from it. No other merit is claimed in this dissertation, than the having collected together into one body the scattered

* Percival's Essays.

† Pennant's Arctic Zoology. Vol. I p. 126.

‡ Medical Repository. Vol. I. p. 427.

remarks and opinions of various writers. If this essay should direct the attention of some future enterprizing genius to this too much neglected subject, and if it should meet with the approbation of those, whose esteem the writer is most anxious to deserve, he will be amply repaid for his exertions in the field of science.

To depart from this university, without expressing a strong sense of the advantages it offers, in the prosecution of the study of medicine, would be highly unjust and ungrateful. To the numerous testimonies of the zeal, diligence, and abilities of the different medical professors, mine is now cheerfully added. To some of them I am indebted, not only for public instruction, but for numerous private acts of friendship and politeness. To these I now offer publicly my sincere thanks.

F I N I S.

